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54. (New) The printhead according to claim 1, wherein said input portion includes a shift register for sequentially shifting the received image data with the same number of bits as the bus format.

REMARKS

Reconsideration and withdrawal of the rejection set forth in the above-mentioned Official Action in view of the foregoing amendments and the following remarks are respectfully requested.

Claims 1-15, 17-28, 30-35, 40, 42-45, 47, 48, 50, 51, 53 and 54 are now pending in the application, with Claims 1, 7, 15, 22, 25, 28, 32 and 40 being independent. Claims 16, 29, 36-39, 41, 46, 49 and 52 have been cancelled without prejudice. Claims 1, 7, 15, 22, 25, 28, 32, 40, 47, 50 and 53 have been amended and Claim 54 has been added herein.

Claims 1-53 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 5,907,331 (Markham) in view of U.S. Patent No. 4,649,401 (Kojima et al.). This rejection is respectfully traversed.

Independent Claims 1, 22 and 32 each recite, inter alia, that the image data and block selection data are received by the printhead or output to the printhead through common signal lines in a bus format of a plurality of bits. As a result, data transfer speed to the printhead can be increased without increasing the number of signal lines, even if the number of printing elements is increased.

Markham relates to an ink jet printhead having on-chip circuitry 18. The printhead includes an array of ink jet ejectors 16, a data shift register 30, a latch 32, a token shift register 34 and a mode shift register 36. The head is further provided with a DATA/DIR line for serially receiving mode data, direction data and image data. Applicant submits that mode data in Markham is used to define one of the printing modes shown in the table of column 6 and a block is selected by the token digit outputted from the token shift register 34. However, there is no disclosure or suggestion of image data and block selection data being outputted to or received by a printhead through common signal lines in a bus format of a plurality of bits, as is recited in independent Claims 1, 22 and 32.

Thus, Markham fails to disclose or suggest important features of the present invention recited in independent Claims 1, 22 and 32.

Kojima et al. relates to a thermal recording apparatus including a head having heating elements, a driver circuit and a control circuit. As understood by Applicant, the driver circuit receives image data in a bus format of D_0 to D_7 . However, Kojima et al. is not believed to remedy the deficiencies of Markham noted above with respect to independent Claims 1, 22 and 32.

Thus, independent Claims 1, 22 and 32 are patentable over the citations of record.

Independent Claims 7 and 25 each recite, inter alia, that an input portion of a printhead includes a shift register for sequentially shifting received image data with the same number of bits as a bus format in which the image data is received. As a result, the data transfer speed in the printhead can be increased by a simple construction.

As to Markham, there is no disclosure that the shift register shifts the image data with the same number of bits as the bus format of the received image data. Regarding Kojima et al., Applicant submits that the shift registers 37 in Fig. 7 shift one bit data to one of the next shift registers 36. This is quite different from the data transfer of the present invention. Thus, any combination of Markham and Kojima et al. would not result in those features recited in independent Claims 7 and 25.

Thus, independent Claims 7 and 25 are also patentable over the citations of record.

Independent Claims 15, 28 and 40 each recite, inter alia, continuously receiving or outputting image data and data for setting a printing element driving time through common signal lines. As a result, the number of signal lines used for data transfer to the printhead can be reduced without decreasing the data transfer speed, thereby enabling the size of the printhead to be reduced.

Applicant respectfully submits that the mode data and direction data in Markham have no relation to the printing element driving time. That is, the mode data is used to define one of the printing modes and the direction data is used to define the scanning direction. The common output or receipt of image data and driving time setting data through common signal lines is also not disclosed or suggested in Kojima et al. Thus, the features of independent Claims 15, 28 and 40 are also not disclosed or suggested by the citations of record, thus also rendering those claims patentable.

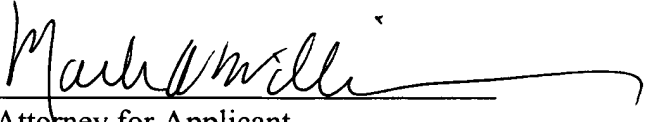
Thus, independent Claims 1, 7, 15, 22, 25, 28, 32 and 40 are patentable over the citations of record. Reconsideration and withdrawal of the § 103 rejection are respectfully requested.

For the foregoing reasons, Applicant respectfully submits that the present invention is patentably defined by independent Claims 1, 7, 15, 22, 25, 28, 32 and 40. Dependent Claims 2-6, 8-14, 17-21, 23, 24, 26, 27, 30, 31, 33-35, 42-45, 47, 48, 50, 51, 53 and 54 are also allowable, in their own right, for defining features of the present invention in addition to those recited in their respective independent claims. Individual consideration of the dependent claims is requested.

Applicant submits that the present application is in condition for allowance. Favorable reconsideration, withdrawal of the rejection set forth in the above-noted Office Action, and an early Notice of Allowance are requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,


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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Three Times Amended) A printhead comprising:
 - a plurality of printing elements for printing;
 - a block selection circuit that outputs a selection signal for selecting a block comprising a plurality of printing elements;
 - a printing control circuit which outputs a driving signal for selectively driving said printing elements, together with the selection signal, to each of said printing elements in correspondence with image data; and
 - an input portion, which receives external image data to be input to said printing control circuit,
 - wherein said input portion is adapted to receive the image data and block selection data input to said block selection circuit through common signal lines in a bus format of a plurality of bits from outside of the printhead.

7. (Three Times Amended) A printhead comprising:
 - a plurality of printing elements for printing;
 - a block selection circuit that outputs a selection signal for selecting a block comprising a plurality of printing elements;
 - a printing control circuit which outputs a driving signal for selectively driving said printing elements, together with the selection signal, to each of said printing elements in correspondence with image data; and

an input portion, which receives external image data to be input to said printing control circuit,

wherein said input portion is adapted to receive the image data in a bus format of a plurality of bits, and the input portion includes a shift register for sequentially shifting the received image data with the same number of bits as the bus format.

15. (Three Times Amended) A printhead comprising:

a plurality of printing elements for printing;

a block selection circuit that outputs a selection signal for selecting a block comprising a plurality of printing elements;

a printing control circuit which outputs a driving signal for selectively driving said printing elements, together with the selection signal, to each of said printing elements in correspondence with image data; and

an input portion, which receives external image data to be input to said printing control circuit,

wherein said input portion is adapted to continuously receive the image data and data [associated with] for setting a printing element driving [timing] time through common signal lines from outside of the printhead.

22. (Three Times Amended) A method of driving a printhead including

a plurality of printing elements for printing, a block selection circuit for outputting a selection signal for selecting a block of a plurality of printing elements, a printing control

circuit for outputting a driving signal for selectively driving the printing elements, together with the selection signal, to each of the printing elements in correspondence with image data, and input means for receiving external image data to be input to the printing control circuit, said method comprising the steps of:

causing the input means to receive the external image data and block selection data input to the block selection circuit through common signal lines in a bus format of a plurality of bits from outside of the printhead; and

causing the printing control circuit to drive the printing elements of the block selected by the block selection circuit in correspondence with the image data.

25. (Three Times Amended) A method of driving a printhead including a plurality of printing elements for printing, a block selection circuit for outputting a selection signal for selecting a block of a plurality of printing elements, a printing control circuit for outputting a driving signal for selectively driving the printing elements, together with the selection signal, to each of the printing elements in correspondence with image data, and input means for receiving external image data to be input to the printing control circuit, said method comprising the steps of:

causing the input means to receive the external image data in a bus format of a plurality of bits; and

causing the printing control circuit to drive the printing elements of the block selected by the block selection circuit in correspondence with the image data,

wherein the input means includes a shift register for sequentially shifting the received image data with the same number of bits as the bus format.

28. (Three Times Amended) A method of driving a printhead including a plurality of printing elements for printing, a block selection circuit for outputting a selection signal for selecting a block of a plurality of printing elements, a printing control circuit for outputting a driving signal for selectively driving the printing elements, together with the selection signal, to each of the printing elements in correspondence with image data, and input means for receiving external image data to be input to the printing control circuit, said method comprising the steps of:

causing the input means to receive data [associated with] for setting a printing element driving [timing] time continuously with the image data through the same signal lines as the image data from outside of the printhead; and

causing the printing control circuit to drive the printing elements of the block selected by the block selection circuit in correspondence with the image data.

32. (Three Times Amended) A data output apparatus for outputting image data and a block selection signal to an input portion of a printhead, the printhead including (i) a plurality of printing elements for printing, (ii) a block selection circuit for outputting the selection signal for selecting a block of a plurality of printing elements, (iii) a printing control circuit for outputting a driving signal for selectively driving the printing elements together with the selection signal to each of the printing elements in

correspondence with the image data, and (iv) the input portion, which receives external image data to be input to the printing control circuit, said apparatus comprising:

an output unit that outputs the image data and block selection data input to the block selection circuit to the printhead through common signal lines in a bus format of a plurality of bits.

40. (Three Times Amended) A data output apparatus for outputting image data to an input portion of a printhead, the printhead including (i) a plurality of printing elements for printing, (ii) a block selection circuit for outputting [the] a selection signal for selecting a block of a plurality of printing elements, (iii) a printing control circuit for outputting a driving signal for selectively driving the printing elements in the block, the printing control circuit adapted to output the driving signal together with the selection signal to each of the printing elements in correspondence with the image data, and (iv) the input portion, which receives external image data to be input to the printing control circuit,

wherein said data output apparatus continuously outputs the image data and data [associated with] for setting a printing element driving [timing] time to the printhead through common signal lines.

47. (Amended) The printhead according to claim 15, wherein said input portion is adapted to receive the image data and the data [associated with] for setting the printing element driving [timing] time in the same bus format.

50. (Amended) The method according to claim 28, wherein the input means receives the image data and the data [associated with] for setting the printing element [drive timing] driving time in the same bus format.

53. (Amended) The apparatus according to claim 40, wherein the image data and the data [associated with] for setting the printing element [drive timing] driving time are output in the same bus format.

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